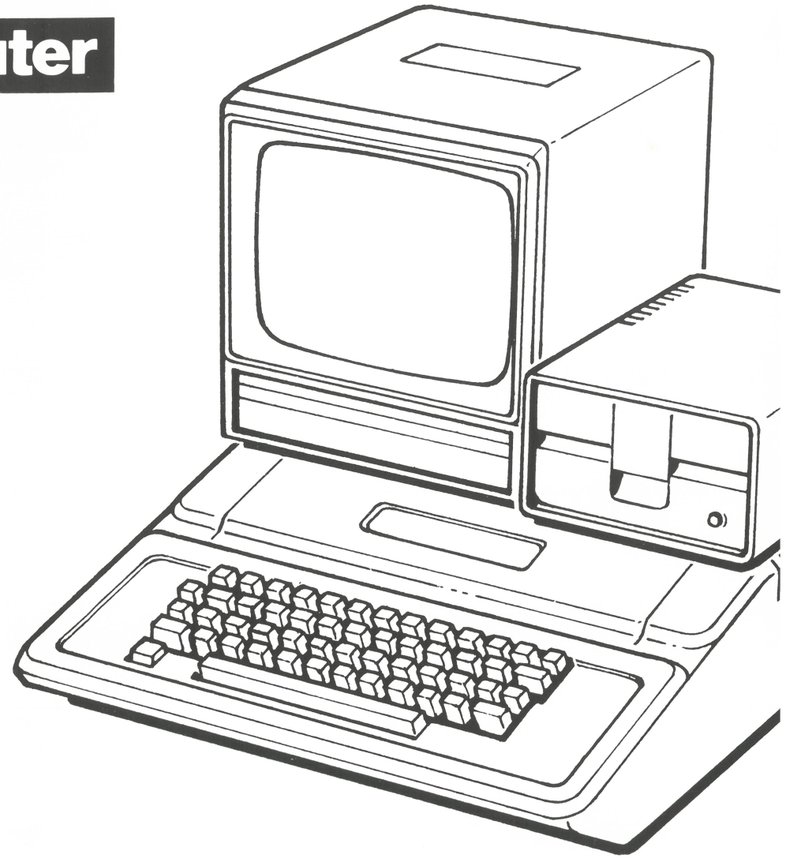
E.M.E

microcomputer program



ELECTRIC CIRCUITS

STUDY GUIDE

by

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OVERVIEW

The E.M.E ELECTRIC CIRCUITS program will help middle and upper grade elementary students understand basic concepts of electricity and solve problems dealing with simple circuits. The program consists of two parts:

1. Explanation -- introduces the basic elements of a circuit: cells, terminals, switches, wire and bulb structure. Describes how a circuit is made; open, closed and short circuits; conductors and insulators. A convenient forward/backward feature allows review at any point.

2. Quiz -- consists of two sections each with 20 randomly-selected questions. Quiz score is given at the end of each part.

   A. Simple Circuits: tests student understanding by having them determine whether or not a bulb in a diagrammed circuit will "light".

   B. Conductors and Insulators: with a conductor or insulator in the circuit, students must again decide whether or not the bulb will "light".

After studying the Explanation section of the program students will be ready to build simple circuits on their own and to solve the problems found in the Quiz sections of the program.

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OBJECTIVES

The following concepts are developed in the program:

1. Electric current can travel in a circuit that is closed.
2. A switch is a device which opens or closes a circuit.
3. A short circuit is a circuit in which electricity follows a lower-resistance path that bypasses a bulb or other device presenting greater resistance.
4. Conductors are materials through which current can travel easily.
5. Insulators are materials through which current has difficulty traveling.
6. Energy can be changed from one form to another.

After using this program students will be able to:

1. Recognize and build closed, open and short circuits.
2. Describe the function of a switch in a circuit.
3. Tell if closing a switch in a given circuit will cause the bulb (lamp) to light or not and explain why.
4. Test materials to find out whether they are insulators or conductors.

USING THE PROGRAM

The E.M.E ELECTRIC CIRCUITS program is easy to use and is under your control at all times. The program loads automatically and is ready to use immediately. We suggest that students start with the Explanation section. This provides the background needed to understand electric circuits and to answer the questions in the Quiz sections. The program is designed for Grades 4 and up. When using Apple IIe or IIc, be sure CAPS LOCK key remains down.

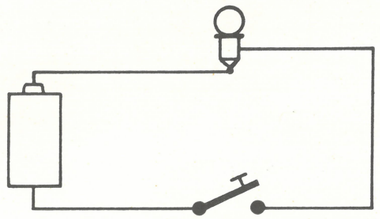
You may wish to assign as your representative at the computer a student who has already taken the quiz to record the scores of other students taking the quiz. The Quiz sections of ELECTRIC CIRCUITS may also be used as an evaluation instrument by teachers who have completed a unit on electricity.

BACKGROUND

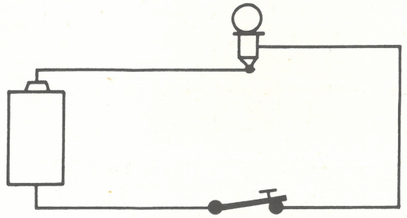
SAFETY NOTE: The activities illustrated in this program use current generated by a D-Cell (common flashlight battery) which does not have any electricity in it. It produces an electric current by chemical action when wires are connected to it in a circuit. Caution children NEVER to use household current to do any of the experiments presented in the program.

A circuit is the pathway a current travels. A switch is used to open or close a circuit. It operates like a drawbridge. When the bridge (switch) is open the

traffic (electricity) cannot travel across it but when the bridge (switch) is closed it can.

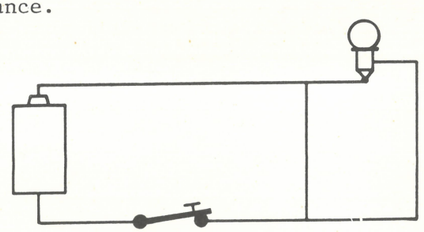


OPEN CIRCUIT



CLOSED CIRCUIT

There is another kind of circuit covered in the program -- the short circuit. A short circuit is created when the current bypasses most of the resistance in the circuit. (A bulb in a circuit may be considered the resistance, as may a doorbell or any other device which works on electricity.) In a short circuit the current takes the path of least resistance.

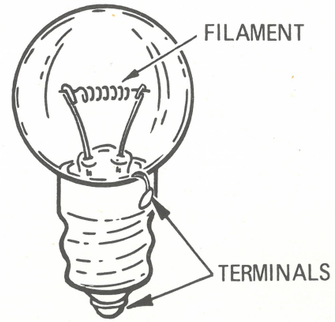


SHORT CIRCUIT

In this case the path of least resistance bypasses the bulb. The wire becomes hot and the battery runs down. Short circuits are dangerous in homes and other locations because wires may become hot enough to start a fire. Fuses and circuit breakers are switches that shut off the electricity when a circuit is overloaded. They protect homes, cars and buildings from electrical fires.

Materials that allow current to travel easily in a circuit are called conductors and are usually metal. For example, copper is an excellent conductor of electricity. Materials that do not readily conduct electricity are called insulators. Glass, rubber and wood are examples.

A bulb has two terminals through which the current flows. The terminals are connected by a filament "bridge" usually made of fine tungsten wire which has a high electrical resistance and does not melt at high temperatures. A tungsten filament converts electrical energy to light and heat energy.



In a bulb ordinary air is replaced by nitrogen and argon gases because they do not react with tungsten, thus increasing the life of the bulb's filament.

GLOSSARY

cell: A device that generates electricity by chemical action.

circuit: A path capable of carrying electric current.

conductor: Matter through which electric current will travel easily in a closed circuit. Examples are most metals, including copper and iron.

filament: Fine metallic wire in a bulb which is heated by an electric current to produce light.

insulator: Matter through which electric current has difficulty traveling. Examples are most non-metals including wood, rubber and glass.

open circuit: A circuit with a gap that prevents electric current from traveling.

resistance: The opposition that a substance offers to the flow of electric current.

short circuit: A circuit in which electric current takes a path of low resistance.

switch: A device used to open or close an electric circuit.

terminal: The point at which an electric circuit connection is made. Batteries and bulbs each have two terminals.

This program uses a high-speed operating system called Diversi - DOS (tm) under license. For information contact DSR, Inc., 34880 Bunker Hill, Farmington MI 48018.

RESOURCES

Ardley, Neil: DISCOVERING ELECTRICITY, Franklin Watts, New York, 1984.

Epstein, Samuel and Epstein, Beryl: THE FIRST BOOK OF ELECTRICITY, Franklin Watts, New York, 1977.

Math, Irwin: WIRES AND WATTS: UNDERSTANDING AND USING ELECTRICITY, Scribner, New York, 1981.

Shapp, Martha and Shapp, Charles: LET'S FIND OUT ABOUT ELECTRICITY, Franklin Watts, New York, 1975.

Wade, Harlan: A BOOK ABOUT ELECTRICITY, Raintree, Milwaukee, 1979.

STUDENT WORKSHEET ANSWERS

1. Conductors: copper, iron, zinc, aluminum, silver
   Insulators: silk, wood, glass, plastic, crayon, rubber, paper

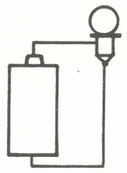
2. two

3. Tungsten is used as the filament because of its high electrical resistance and high melting point.

4. switch

5.

A.



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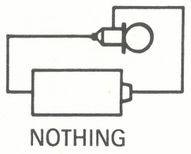

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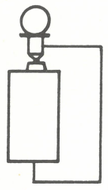

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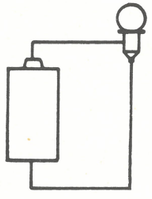

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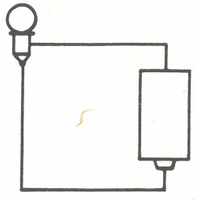


Name_____ Student Worksheet

ELECTRIC CIRCUITS

1. Write a C next to each substance that is a good conductor of electricity and an I next to each insulator.

_____copper	_____iron	_____glass	_____rubber
_____silk	_____zinc	_____plastic	_____paper
_____wood	_____aluminum	_____crayon	_____silver

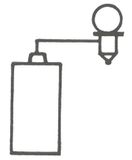
2. How many terminals does a light bulb have?_____

3. What is tungsten used for in a light bulb?_____Why?

4. A device that opens or closes an electric circuit is called a _____.

5. Complete the diagram or write a description of what, if anything, must be done to light the bulb in each circuit below.

A.



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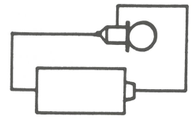

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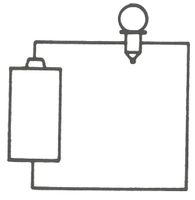

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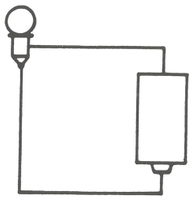

TEXTBOOK CORRELATION GUIDE

Addison Wesley	
Science	Book 4, Chapter 3 Book 6, Chapter 5
Coronado	
Science & Technology	Book 3, Unit 3, Chapter 10 Book 6, Unit 4, Chapter 19
Harcourt Brace	
Science	Book 3, Unit 5, Chapter 3 Book 6, Unit 4, Chapters 1-4
Heath	
Science	Book 3, Unit 3, Chapter 8
Holt	
Elementary Science	Book 3, Unit 4, Chapter 8 Book 5, Unit 6, Chapter 17
Laidlaw	
Exploring Science	Book 5, Unit 3, Chapters 1,2 Book 6, Unit 4, Chapter 1
Merrill	
Accent on Science	Book 4, Unit 8, Chapters 2,3 Book 6, Unit 8, Chapter 1
Scott Foresman	
Science	Book 3, Chapter 6 Book 6, Chapter 13
Silver Burdett	
Science	Book 4, Unit 2, Chapter 8 Book 5, Unit 2, Chapter 7 Book 6, Unit 2, Chapter 8